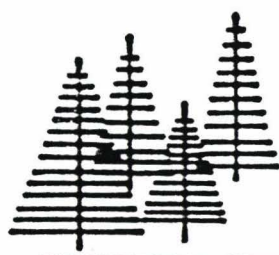


SB761
U7I5
#91-06

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE



FOREST PEST MANAGEMENT



4

B4-91-06

STATE & PRIVATE FORESTRY

AN EVALUATION OF THE PROPOSED DWARF MISTLETOE CONTROL PROJECT, SIDE HOLLOW
TIMBER SALE, ESCALANTE RANGER DISTRICT, DIXIE NATIONAL FOREST

By
John Guyon and Valerie DeBlander

Introduction

On October 21-24, 1991 Plant Pathologist John Guyon and Forestry Technician Valerie DeBlander from the Ogden Field Office of Forest Pest Management, cooperating with personnel from the Escalante Ranger District¹, evaluated and mapped a proposed dwarf mistletoe suppression project located on the Escalante Ranger district. The proposed project, consisting of approximately 996 acres, is in the Side Hollow Timber Sale.

This area consists of mainly Ponderosa pine with an occasional Douglas-fir on north-facing slopes. Most of the larger diameter trees (greater than 8") were cut from 1986-1989 in this area to salvage mountain pine beetle, Dendroctonus ponderosae-killed trees and reduce the risk of further beetle infestation. An effort was made in the cutting units to leave trees that would provide a good source of genetic material to revegetate the site. However, much of the residual stand has dwarf mistletoe (DM) infected trees.

The invaluable assistance of Keith Adams, Ted Hurst, Curtis Chynoweth, Darrell Reid, Verna Goetzinger, Charlotte Coleman, Wade Beebe and Sandy Weaver is greatly appreciated.

LIBRARY COPY
ROCKY MT. FOREST & RANGE
EXPERIMENT STATION

INTERMOUNTAIN
REGION

Methods

Two-hundred and fifty-six temporary plots were installed at 8 chain intervals along transect lines 4 chains apart running north and south. At each plot, a BAF 20 or 10 variable radius plot was used to acquire data from the overstory. A 1/300th of an acre fixed radius plot was also established to collect data on the understory. The first eight lines were surveyed at the 20 BAF level. The sampling intensity was changed from 20 BAF to 10 BAF after line eight due to a change in the density of the stand and to streamline survey procedures. Trees in the overstory were divided into two groups: sawtimber-trees, over 8" DBH; and pole-sized-trees from 5 to 8" DBH. All trees less than 5" DBH were considered to be in the understory. Height was recorded for each understory tree. All trees were given a DM rating using Hawksworth's 6 class system. The severity of DM infection was divided into four classes for the stands surrounding the plots. These 4 classes are defined as follows:

Low - trees rated as primarily 1's & 2's using Hawksworth's system and/or 1-33% of the trees were infected.

Moderate - trees rated primarily 3's & 4's and/or 34-66% of the trees were infected.

High - Trees rated primarily 5's & 6's and/or more than 66% of the trees were infected

Clean - No trees were infected with DM

The severity of DM infection for the entire area was delineated on a topographic map by recording the infection class for a rectangular area 4 chains wide by 8 chains in between each plot center (Figure 1.). The rating of each rectangle was accomplished by visually rating the area surrounding the transect line as each three person crew walked to the next plot. Two members of the crew walked away from the transect line perpendicularly on each side after each variable radius plot was completed. These two people on the "wings" were responsible for rating the level of DM infection for 1 chain on either side of their transect line. The center person was responsible for maintaining the direction of the transect lines and distance to the next plot. Each crew would walk to the next plot rating the level of DM infection along thier respective transect lines.

The ratings of the level of DM infection are displayed in Figure 2. It is important to emphasize that each plot rating applies to the area immediately preceding each variable radius plot. The direction of each transect line is indicated on the map with arrows.

Figure 2. reveals that the DM occurs in rather large patches. The patches can be divided into three groups; no DM, light DM and moderate to high DM. Despite the variation in DM intensity within the patches, each large patch can be treated as a single unit for management purposes. Therefore, the patches were stratified into the three levels mentioned above for analysis. The height growth measurement of the understory trees was performed to evaluate if understory trees in infected areas exceeded critical levels.

Stand and Disease Information

Healthy Areas: Eighty-eight plots were established in healthy areas. Only 0.7 percent of the plots associated with healthy areas had any sign of DM infection. There were no dead trees in any of the healthy plots. Data from the variable radius (VR) plots indicated that there were an average of 45.9 square feet/acre of BA in trees over 5" DBH. Only 6 Douglas-fir were found in the healthy areas.

Data from the fixed radius (FR) plots indicated there were 34.1 understory trees per acre in the healthy areas. This scarcity of regeneration was similar to conditions found in all the infected areas.

Low Infection Areas: Sixty-one plots were established in lightly infected areas which averaged 49.7 square feet of basal area in trees over 5" DBH. Of those trees, 0.4 percent were estimated to have died in the last five years. Recent mortality often exhibited signs of heavy DM infection. At a rotation age of 100 years this rate of infection (0.4 percent in 5 years) would equate to a loss of 8 percent of the trees now alive in the lightly infected areas. Within these areas, 14.8 percent of the trees were infected with DM and the average dwarf mistletoe rating (DMR) for all the trees in the area was 0.56. The infected trees had an average DMR of 2.79.

There were 29.5 stems of understory trees per acre within the FR plots. None of the understory trees had any sign of DM infection.

Moderate to Heavily Infected Areas: One-hundred and seven VR plots were established in moderate to heavily infected areas. Within these areas there were 39.1 square feet of basal area per acre in trees over 5" DBH. Of the

overstory trees, 4.8 percent had died within the past five years. Many of the recently dead trees had significant evidence of DM infection. At the current rate of mortality, 62.4% of the trees alive would be dead within 100 years. The DMR of the infected trees was 4.28 and the stand DMR was 2.75. Trees at this level of DM infection are experiencing growth reductions of 20-50 percent. In thirty years the average DMR of the infected trees in these areas will be approaching 6 and growth will be less than 50 percent of normal.

The FR plot results from the heavily infected areas showed 150 trees per acre in the understory and 52.2 percent of these trees had visible signs of DM infection. Most of the understory trees exceeded the height, 3 feet, above which DM infection becomes progressively more likely.

Discussion

Over one-third of the proposed project area has no DM infection. No control measures are necessary in these areas other than protection from adjacent infected trees. Protecting these healthy areas would involve the cutting of DM free buffer strips into the infected areas adjoining clean areas. In the low infection areas the understory is very sparse and isn't infected with DM. The unusually wide spacing of the overstory contributes to the area being lightly (15%) infected. To achieve effective control, all or nearly all of the infected trees would need to be removed. Of these infected trees 42% would be considered sub-merchantable. Also, after 5-10 years, reentry into these areas would be necessary to clean up latent infections. Performing these options at this time may not be economically feasible.

In the moderate to heavily infected areas both the understory and overstory are infected. If predicted values for latent infections are added in, it is probable that 75-90% of the trees are actually infected. Although stand

replacement would be preferred in these heavily infected areas, clearcutting may not be advisable due to regeneration problems encountered in this area. Therefore, shelterwood treatments, buffer strips to protect non-infected areas, and sanitation treatments are discussed in the options section. The intent is to suggest biologically sound DM suppression treatments that have worked in other areas. The foresters and silviculturalists involved can then apply these treatments as best fits the conditions.

Management Alternatives

Option 1 No Action

Under this management option, the infected trees will increase one DM class every 10-15 years resulting in growth loss of 30-70 percent. The rate of spread into adjacent healthy areas would be 2 ft./yr. Mortality would continue to occur at a rate of 4.8%/5 yrs in the moderate to heavily infected areas. A stand conversion to a non-forest type may occur due to poor regeneration.

Option 2 Shelterwood and Thinning

In moderate to heavily infected areas perform a low density shelterwood by thinning to an adequate stocking level, thus ameliorating the site for planted stock. Leaving as much woody material as possible on the site would help to create microsites suitable for tree planting. In lightly infected areas harvest all infected trees >8" DBH and cut or kill all live infected trees <8" DBH. Reentry into these stands after 5-10 years to clean up latent infections will be needed. In the first entry all the infected trees (15 percent of the total) should be removed. In the second entry an additional 7-8 percent of the trees, those which have latent infections, will need to be removed.

Option 3 Buffer Strips

Buffer strips would be cut into the infected areas wherever infected areas adjoined healthy areas. In this option the healthy areas would be protected by these 100 foot wide buffer strips. There would be no distinction made between light and heavily infected areas with regard to the location of these buffer strips. The results would be similar to the no action alternative for the infected areas. This treatment would prevent DM invasion into the healthy areas.

Option 4

Multiple entries into infected stands by expanding buffer strips. This type of treatment would begin as in Option 3 except an additional buffer strip would be cut into the infected stand every 10 years. In this treatment each buffer strip could be planted after the strip is cut.

Option 5

Buffers strips plus thinning. This treatment would be the same as Option 4 except the buffer strips would be cut where the lightly infected areas adjoined the healthy stands. The lightly infected stands would be treated as in Option 2 by harvesting all infected trees >8" DBH, and a sanitation cut of infected trees <8" DBH.

Objective

The objective is to reduce losses due to dwarf mistletoe infection to acceptable levels through efficient and economical efforts that meet resources objectives. Losses due to Southwestern Dwarf Mistletoe (SWDM) in established stands can be reduced without attempting to eradicate the disease.

SOUTHWESTERN DWARF MISTLETOE

Southwestern dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum), is the most damaging disease of southwestern ponderosa pine (Pinus ponderosa) var. scopulorum. The disease causes: mortality and growth reduction in infected ponderosa pine (Pinus ponderosa); a decrease in the quantity, quality, and germination percentage of seeds produced; lowers timber quality; and can adversely effect recreation values. SWDM can be either detrimental or beneficial to wildlife values. Heavily infected trees are more susceptible to attacks by insects and other diseases and to environmental stresses such as drought. Heavily infected trees may sustain a 20 to 50 percent reduction in growth compared to non-infected trees. Dwarf mistletoe infects trees of all ages, and is therefore a problem in second growth and regeneration, as well as mature and overmature stands.

Biology

Dwarf mistletoes are parasitic, seed-bearing plants that depend on their hosts almost completely for their water and nutrients. Spread of SWDM occurs in late July and early August when water pressure builds up inside the mature fruits and the seeds are expelled to distances ranging from 17 to 40 feet. The average

horizontal distance of seed flight is between 15 and 20 feet. Infection of trees through the bark on needle-bearing shoots occurs within a few months after dispersal. Aerial shoots appear between 2 to 5 years after infection. Spread of SWDM in ponderosa pine stands is a function of stand age, density, and site index, and averages 1 to 2 feet a year through a single-storied stand. Spread is most efficient and rapid from an infected overstory to an understory and slowest through even-aged stands.

Prevention

Prevention is the most efficient and economical method of reducing dwarf mistletoe impact. To prevent an infestation from starting, all infected trees should either be removed or killed in each regeneration area, including burns, before the new stand can become infected. Boundaries should be located in uninfected or non-host type stands, or along natural breaks. Trees which do become infected should be removed during intermediate cuts.

Silvicultural Control

Losses due to SWDM throughout the ponderosa pine stands can be effectively reduced to acceptable levels in managed stands through judicial thinnings and regeneration cuts. Because the distribution of SWDM tends to be very patchy, selective removal of DM infected overstory will be needed to reduce the spread of the disease. Major management options include the following:

- (1) Regenerate the infected stand using treatment layouts which reduce reinvasion by the pathogen.
- (2) Remove infected trees and improve tree growth by thinning.
- (3) Change stand composition to non-susceptible hosts.
- (4) Remove infected residuals from logged or burned stands.

Stands with a DMR of 4, 5, or 6 are heavily infected and are declining in growth rate and vigor, and are poor risk trees. Heavily infected patches usually contain infected pines of all age and size classes. Thinning heavily infected stands will only accelerate the spread of the disease and cause increased growth reduction and subsequent tree mortality. Heavily infected stands that will not provide acceptable yields or meet other objectives should be regenerated. Stands should be regenerated through shelterwood or clear cuttings to remove the infection source and establish a new vigorous stand. The best regeneration method is clearcutting infected patches. The size of clearcuts should be at least 20 acres to reduce the amount of infection in the regeneration from the infected edges.

When infected trees must be left for shelter or seed source, trees with infection in the lower third of the crown should be favored over more heavily infected trees. Pruning the infected branches of leave-trees could increase the number of years before the regeneration becomes infected. Cut these (and all other) infected overstory trees once regeneration is established in the cut area, but no later than 10 years. The new stand should be thinned about five years after overstory removal. This allows diagnosis of most latent infections.

Planting more than the usual amount of seedlings underneath the infected leave-trees, could result in a greater numbers of healthy trees remaining after the infected leave-trees and any infected seedlings are cut.

Treatment of Stands with Light Infection

Stands with a DMR or 1, 2, or 3 are lightly infected and usually result in little or no impact on growth of pole- and sawtimber-size trees. Lightly

infected trees may be left in even-aged stands if they are otherwise desirable as crop trees and needed for stocking. Since the majority of SWDM seeds fall within 30 feet of the parent plant, spacing lightly infected leave trees in even-aged stands at distances greater than 30 feet should substantially reduce the rate of spread in these stands. Infected trees should be discriminated against during any intermediate cuttings.

Pruning

Pruning should only be used on large, valuable trees that would retain at least 30 percent live crown after pruning. Pruning is used when lightly infected trees, pole size or smaller, can be sanitized and there is little chance they will be reinfected. Two whorls of branches above the highest visibly infected branch should also be removed to eliminate latent infections. The following three steps should be used in removing large tree limbs:

- (1) Undercut a few inches away from the main trunk to prevent bark stripping.
- (2) Remove the limb with a cut just outside the undercut.
- (3) Remove the stub with a cut at the branch collar.

Sanitation and Thinning

Sanitation cutting and thinning is used to maximize growth of lightly infected and healthy trees. Infected trees should be discriminated against when cutting.

Chemical Control

The growth regulator FlorelTM, containing the active ingredient ethephon has been approved by the EPA for use on dwarf mistletoes. Research suggest this chemical has "potential" in limiting the spread of the disease in high-use

developed sites and home sites. The use of ethephon is only a temporary means of limiting the spread of dwarf mistletoes. Etethephon causes the dwarf mistletoe plants to separate from the host. The dwarf mistletoe is still active within the host and will produce aerial shoots in 2 to 5 years. This growth regulator should only be applied to high-value trees due to the expense of the treatment. Sufficient guidance from knowledgeable professionals is recommended in the use and application of ethephon.

FOREST PEST MANAGEMENT ASSISTANCE

Forest Pest Management can assist the District in surveying areas in need of treatment and can provide funding for dwarf mistletoe suppression. Control of dwarf mistletoe can be funded by timber sale, KV, reforestation and stand improvement, and FPM funds. Funding will be shared with other benefiting resource areas. Requests for FPM funds for dwarf mistletoe control should be submitted to the Forest Supervisor and incorporated in the multi-year Program Development and Budget process (FSM 3462.14 R-4 SUPP 3).

When the decision is made on what treatment option is best for the District, a project proposal, FS-3400-2 should be submitted to Forest Pest Management for funding in the year the treatment is expected to be accomplished. Wherever possible, receipts from timber sales or funding from other benefitting resource areas should be used to offset the cost to FPM. Multi-funded programs help stretch FPM dollars and allow additional accomplishments in other areas.

We've enjoyed working with the District personnel on this project. The Dixie NF seems committed to quality in dealing with forest pests.

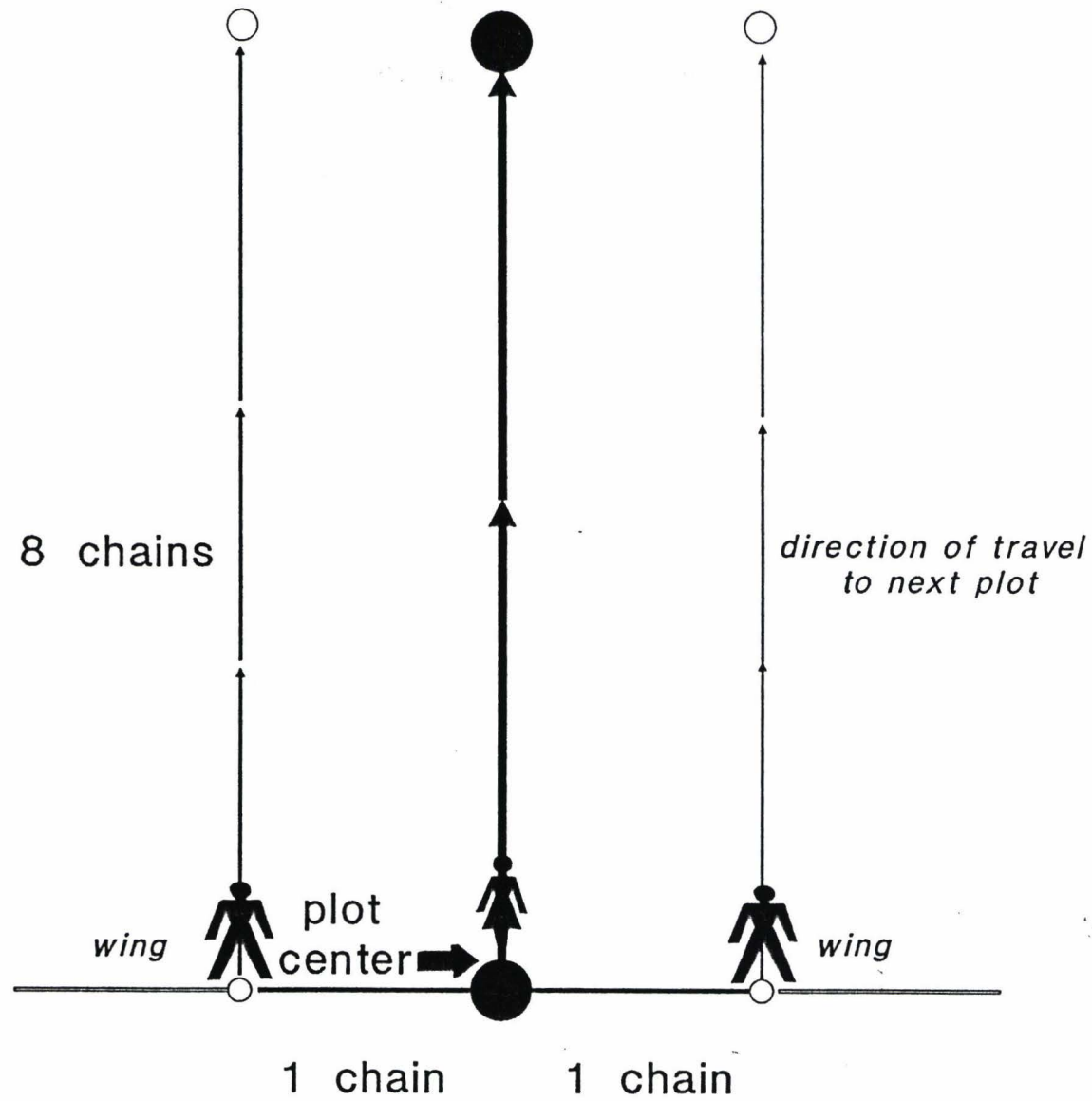


Figure 1. Survey Design

